

Discovery of Brownleeite: a New Manganese Silicide Mineral in an Interplanetary Dust Particle

Keiko Nakamura-Messenger, Lindsay P. Keller, Simon J. Clemett, Scott Messenger John H. Jones, Russell L. Palma, Robert O. Pepin, Wolfgang Klöck, Michael E. Zolensky and Hirokazu Tatsuoka

The Earth accretes approximately 40,000 tons of cosmic dust annually, originating mainly from the disintegration of comets and collisions among asteroids. This cosmic dust, also known as interplanetary dust particles (IDPs), is a subject of intense interest since it is made of the original building blocks of our Solar System. Although the specific parent bodies of IDPs are unknown, the anhydrous chondritic-porous IDPs (CP-IDPs) subset has been potentially linked to a cometary source. The CP-IDPs are extremely primitive materials based on their unequilibrated mineralogy, C-rich chemistry, and anomalous isotopic signatures. In particular, some CP-IDPs escaped the thermal, aqueous and impact shock processing that has modified or destroyed the original mineralogy of meteorites. Thus, the CP-IDPs represent some of the most primitive solar system materials available for laboratory study.

Most CP-IDPs are comprised of minerals that are common on Earth. However, in the course of an examination of one of the CP-IDPs, we encountered three sub-micrometer sized grains of manganese silicide (MnSi), a phase that has heretofore not been found in nature. In the seminar, we would like to focus on IDP studies and this manganese silicide phase that has been approved as the first new mineral identified from a comet by the International Mineralogical Association (IMA) in 2008.

The mineral is named in honour of Donald E. Brownlee, an American astronomer and a founder of the field of cosmic dust research who is the principal investigator of the NASA Stardust Mission that collected dust samples from Comet 81P/Wild-2 and returned them to Earth. Much of our current view and understanding of the early solar system would not exist without the pioneering work of professor Don Brownlee in the study of IDPs.